Hybrid Passive-Active Vibration Control Systems for Microgravity Payloads

Objective

Many types of flight experiments requiring a microgravity environment are being developed for the International Space Station (ISS). However, since the ISS and the payloads supporting these experiments cannot provide a truly microgravity environment at all locations and times due to various sources of vibrations and vibration control, isolation systems are needed for these experiments. These systems can provide the vibration damping, isolation, and suppression that will achieve the microgravity acceleration levels needed for these experiments. Active vibration control systems for microgravity payloads are currently being developed. However, as a means of supplementing these active systems, hybrid passive-active vibration control systems should also be developed. Every active vibration control system has as its basis a good passive control design. Hybrid systems combine the features of both passive and active vibration control technologies to the point that the passive part helps stabilize the active part. Possible areas of research in hybrid passive-active vibration control are adaptive passive systems, active constrained layer damping, smart materials for electromechanical couplers, and active-passive isolation systems.

Why Needed

Advanced hybrid damping systems can greatly reduce the size and power required and increase the robustness of active control systems. Intelligent mating of passive and active vibration control can maximize performance and reliability of a vibration control system as well as minimize the cost and complexity. The end result can be more effective and successful vibration isolation and control systems for microgravity payloads.

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